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Systematic Review

Systematic Literature Review of Land Use Conflicts in Northern Sweden—Lessons Learned and Ways Forward

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Abstract: Land use conflicts are intensifying in Northern Sweden due to the increasing global demand for resources coupled with the green transition. In line with this, a thorough understanding of land use conflicts in the area is becoming necessary as economic activities expand and newer ones are developed. Hence, this paper aims to provide a systematic literature review of research on land use conflicts specific to Northern Sweden, focusing on various economic activities such as forestry, mining, tourism, energy sector and reindeer husbandry. Additionally, we aim to determine lessons learned and suggested ways forward based on a systematic review. We used Scopus and Web of Science on June 2023 and through descriptive statistical analysis of 33 articles, we summarized research trends and gaps. We found three main typologies of conflicts and five main themes of suggested ways forward. Recommendations agree that there should be a broader understanding of the underlying interests of the stakeholders; and there should be an inclusive, more participatory approach to discussing potential solutions, not to create an agreement but to come to an understanding. Beyond academic insights, the findings hold practical relevance for shaping effective land use policies. This paper offers valuable lessons that extend beyond the local context, informing broader discussions and policy considerations for sustainable land management in the larger Arctic setting, where similar challenges and resource demands are unfolding.

Keywords: economic activities; industry land use; PRISMA 2020 guideline; conflict typologies

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1. Introduction

The increased demand for resources and Arctic globalization, defined as the continuation and intensification of the movement of humans, goods, services, capital, and communication technology in the Arctic, creates friction between societies and cultures. This, in turn, intensifies conflicts over land use [1]. Land use conflicts are not new and exist wherever there is human activity [2]. However, since the turn of the 21st century, land use conflicts are intensifying in the Arctic due to the onset of large-scale mining, forestry, and recently, increased development in the energy and tourism sectors [3–5]. The situation is also exacerbated by competition with traditional land uses [6,7], as the Arctic is home to diverse indigenous communities and traditional land users [8]. Northern Sweden is a case in point, wherein conflicts between economic activities have been going on for centuries [9–11]. Currently, land use conflicts are escalating as Northern Sweden is being perceived as a hub for "green" growth, such as development of the first fossil-free-steel production, and what the mining industry calls green mining [12]. With the 'green transition' considered as a solution to combat climate change, forestry and mining operations are expanding as a response to increased demand of materials for production of renewable energy, e.g., minerals for solar panels, green batteries, and wood for green construction and energy [12,13]. These economic activities overlap with traditional practices such as reindeer

husbandry, which is a longstanding livelihood of the Sámi indigenous people [4,14]. In line with these issues, a thorough understanding of land use conflicts in Northern Sweden is becoming necessary as the industries expand.

Scholars have conducted research and analysis regarding land use conflicts in Northern Sweden over the past decade, producing an ample body of literature [15,16]. However, keeping track of the increasing body of knowledge is becoming challenging, especially with the different economic activities operating in the region. Likewise, there are no published systematic literature reviews on this topic that combine multiple economic activities in the past decade; that could provide knowledge and guidance on how to go forward with the knowledge that has already been created. Moreover, we argue that a comprehensive understanding of land use conflicts provides policy makers with insights into the complex dynamics at play, enabling the formulation of context-specific and sustainable land use policies in order to establish frameworks that balance the diverse needs of stakeholders [17–20]. This study also serves as a foundational work for delving deeper into the nuanced understanding of the current perceptions held by local residents on land use conflicts. It is within this context that this study was conducted. Hence, this paper aims to systematize lessons learned and ways forward regarding land use conflicts in Northern Sweden.

Lessons learned refer to the causes and typologies of conflicts tackled. Ways forward are the suggestions formulated by the authors on how to progress despite the presence of conflict. To address our research objectives, we conducted a systematic literature review that focuses on the results and the authors' recommendations, thereby identifying trends and knowledge gaps that need further research elaboration. Hence, this paper asks: what are the lessons learned in terms of the types of conflicts and their causes described in the literature in Northern Sweden? and what are the ways forward identified in the literature?

Land Use Conflict

Land use conflict is two concepts merged together and scholars agree that there is no coherent understanding of what it encompasses [6,21,22]. The European Environmental Agency [23] defines land use as a functional dimension of areas, e.g., areas used for industrial or commercial purposes, for forestry, recreation, conservation purpose and residential. Land use is, however, not equivalent to land cover and it is difficult to infer the former from the latter. Comber [24] studied the semantics of land cover and land use, and they highlighted that land use is how people utilize the land considering human behavior. This is where multiple stakeholders come into play like decision makers, industries, local and indigenous people. Alternatively, according to the Institute of Local Government [25] land use can also refer to 'non-use' of lands reserved for nature protection and for religious and cultural activities. They emphasize that land use is the relationship of the people to the land and how humans adapt these lands to their own use and non-use.

Conflict on the other hand can have diverse definitions and has been a topic of various research. Conflict can be a violent dispute [26] or a situation wherein two parties perceive a goal incompatibility but do not necessarily engage in a mutually incompatible behavior [27]. However, at its core, conflict happens when two or more parties have divergent or incompatible goals and interests that motivate their behavior [26]. Combining conflict and land use in socio-environmental literature, land use conflict refers to the clash of belief, interests and goals of different parties about the social role of the land. Land use conflict may be analogous to its economic value but, at the same time, it may have less to do with the land resources and more to do with jurisdiction and access to resources [28,29]. Land use conflict can also refer to struggles over land use change such as transforming one land use to others, e.g., forest into agricultural lands and roads [30]. Considering all the previous definitions discussed, we adapt the following definition for this paper and in the preceding systematic review: Land use conflict refers to a goal incompatibility between two or more parties over the use of the land, whether for economic, social or cultural functions. Subsequently, the land uses in focus in this study are the existing economic activities in the region, such as forestry, mining, tourism, energy and reindeer husbandry.

Industries only refer to the first four economic activities since reindeer husbandry is not only a profit-focused market economy, but also a cultural practice intimately tied to the land and the rights of indigenous peoples [31]. Following this definition, we are able to simplify the process of developing the typologies of conflicts, and their corresponding suggested ways forward.

This paper proceeds with a discussion of Northern Sweden as our study area, followed by a brief account of land uses in conflict, and the methodology on how we conducted the systematic literature review. Next, we present and discuss our findings with reference to the papers reviewed. Finally, we offer our conclusion and some key implications.

2. Methodology

2.1. Study Area: Northern Sweden

Northern Sweden is composed of Jämtland, Västernorrland, Västerbotten and Norrbotten counties; see Figure 1. The area constitutes approximately half (49%) of Sweden but only 10% of the population or 1.2 million people resides in the region [32]. Västerbotten and Norrbotten are officially recognized as part of the Arctic. The area is also part of Sápmi or Sámi traditional land, which also encompass the northern parts of Finland and Norway as well as part of the Russian Kola Peninsula [33].

We focus our attention on Northern Sweden because it is a case where land use conflicts are intensifying due to global trends [3] and Arctic globalization [1], which adds pressure to traditional land uses [3,9]. To illustrate, Northern Sweden has a long history of mining with the production of ores and metals. Although the number of mines has decreased at the beginning of the 20th century, production has doubled in 2022 to meet current demands, primarily from China and other Asian countries [8]. In forestry, forest products have been used for centuries mostly for subsistence, but during the 20th century, there was a spike in demand for timber from the expanding forest products industry [34]. Tourism is also experiencing significant growth driven by customer preferences, with increasing interest in adventure tourism and outdoor activities [35]. Northern Sweden attracts nature lovers and outdoor enthusiast with its vast forests, lakes and so-called Arctic experiences—midnight sun, reindeer and husky sleds, northern lights, etc. [36]. In terms of the energy sector, Sweden has become the leader of green energy transition. Set by the government's target to reach 100% renewable energy production by 2045, there has been a rapid increase in wind energy projects [37]. Today, Sweden holds the record of the highest number of wind installations or onshore installations in the whole of Europe [38]. All of these growing economic activities induce land conversions on traditional lands used for reindeer husbandry in Northern Sweden, which results in land use conflicts [14,37]. Studies found that there has been approximately 54% loss of winter grazing lands, which is critical for reindeer survival, because of land use conversion to industrial use, which dates back to the 1900s [7,14]. There is also much evidence of the negative impacts of the industries on reindeer husbandry, i.e., damage to pastures [39]; changes in reindeer behavior [31]; decline in lichen, which are important reindeer food [14], that heightens land use conflicts.

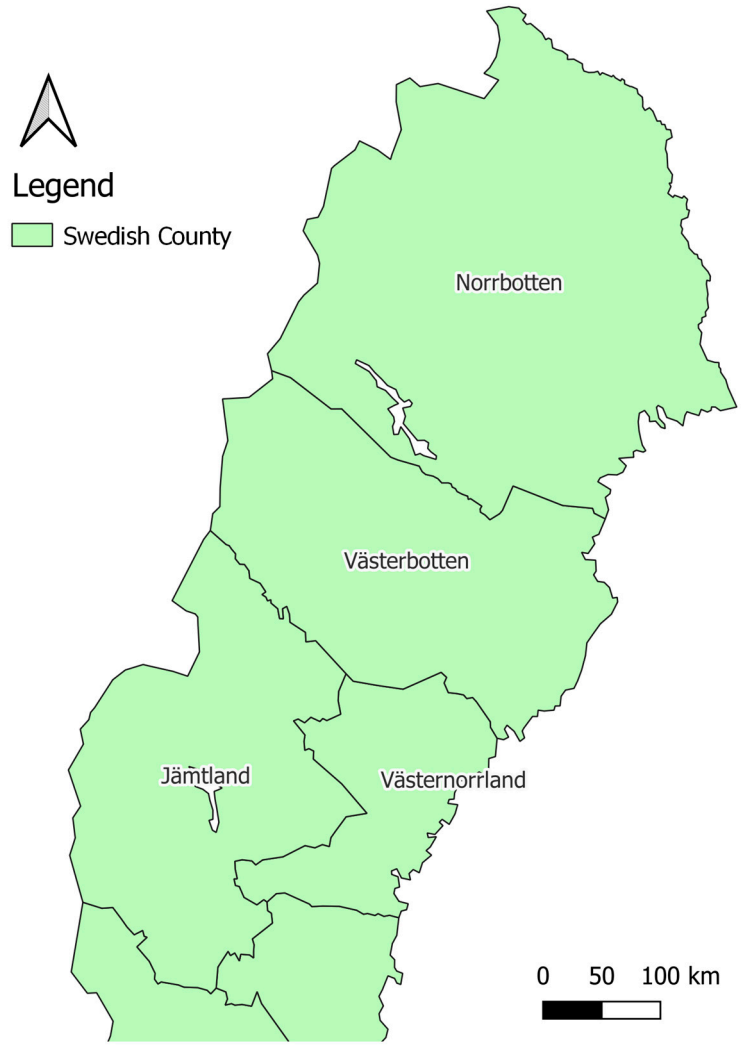

Figure 1. Map of Northern Sweden Counties. Map created in QGIS by author based on data from Lantmäteriet [40]. Available under the Open Data License; Creative Commons, CC0.

2.2. Land Uses in Northern Sweden—Conflicts and Synergies

To provide an overview of the land use conflicts in Northern Sweden, we discuss here the conflicts between each economic activity. However, we would also like to highlight that there are synergies or co-benefits between industries which creates new opportunities for the industries and the local community [5,41].

2.2.1. Energy

Sweden is one of the leaders in the green transition and the country aims to establish 100% renewable energy system by 2040, providing clean electricity, transport system and other measures. To achieve this, the country will need to develop 4000 to 5000 wind turbines by 2040, of which 80% are being built in Northern Sweden [42]. According to Cambou [37], the exponential increase from 48 turbines in 2003 to 1410 in 2019 and approximately 4000 planned wind turbines by 2040 will increase overlaps with Sámi reindeer herding areas. The consequences of building the wind turbines are not only limited to the space they occupy, but also with the power lines, new roads and built-in service area. Noise pollution, dust, increased human activity, especially during construction and visual disturbance, affect the reindeer herding activities. With the new establishments, traditional reindeer herding routes are cutoff and reindeers have to go around built-in areas, therefore increasing herding strain and endangering the herd [37]. Svensson et al. [43] emphasized that developing

more wind energy farms will push reindeer husbandry to their tipping point. Aside from wind energy, hydropower plants in Northern Sweden are also built in Sámi traditional land. Hydropower negatively affects river flow and water quality, causing loss of biodiversity and altering streambeds. These changes in the river and water flow also affect reindeer herding activities and migration [44].

Wind farms also have negative impacts on tourism by fragmenting landscapes, changing the scenic beauty of forested areas and reducing land value [43]. Wind farms also provide inconveniences like noise within a few kilometer radius, and flashing lights from the turbines at night, which can deter tourists [45]. Especially, for outdoor and nature enthusiasts who prefer to visit areas that are less disturbed by human infrastructures.

Wind energy farms also compete with forestry. As Sweden is 70% forest land, onshore windfarms are typically established in forest areas [43,46]. Forest areas have to be cleared to make space for the wind turbines, power lines, service area, road connections and associated infrastructure to install them [47,48]. In addition, felling of forest areas causes further stress to the valuable forest ecosystem services, habitats and wildlife [48]. However, since production forests dominate the country, the risks are lower compared to that of other countries with onshore windfarms [43].

Alternatively, the energy sector has synergies with the mining sector as they work together towards green transition. According to Stockholm Environment Institute [44], Northern Sweden will experience increased energy demand due to the expansion of industrial activities and the planned ventures of Hybrit and H2 Green Steel production, green mining by LKAB, and green battery production by Northvolt. These new activities will need approximately 80 TWh/year, and for reference, the whole of Sweden use 135 TWh in 2020, approximately 60% of the country's energy use.

2.2.2. Forestry

Forestry is an important industry in Northern Sweden, encompassing nearly half of the country's productive forest land [34]. The region is considered to be a key player in the green transition as a source of biobased products and energy that is required to achieve the climate and renewable energy goals of the EU Green Deal. The forestry sector in Northern Sweden employs approximately 22,000 people making it one of the crucial job providers in the rural economy [49].

Forestry activities, i.e., logging, forest management, fertilization, etc., can only be conducted in the region's productive forest lands [50], from which, timber is produced and provides the raw materials for the sawmills, pulp and paper mills and other products such as fiber board, gas, liquids and source for electricity and heat production [51]. However, according to studies [52,53], how forestry is being conducted today negatively affects reindeer husbandry and has been documented for the past 60 years. Forest activities such as large-scale logging, intensive reforestation, fire suppression and soil scarification have drastically reduced the supply of ground and arboreal lichens in the forests, important food sources for reindeers.

Forestry also has land use conflict with tourism as forest activities such as clear cutting, felling and other silviculture treatments can alter the aesthetic of the landscape, potentially diminishing the wilderness appeal of the Northern Sweden. Although this is not necessarily correct, tourists come to the region because it is romanticized to have pristine and untouched nature [54]. Inadvertently, tourism can also benefit from forestry through the use of forest roads, which were initially built for logging and management. These forest roads can provide access to remote and scenic areas, providing hiking, camping and biking opportunities [55].

Forestry and mining in Northern Sweden have limited direct impact nowadays. However, historically, forests were cleared and converted to mining sites hundreds of years ago, and back then, mining sites needed wood for ore extraction and charcoal for smelting and processing [34,56]. Today, the industries have modernized and synergies have been

created, as they use the same railroad and road network to transport their goods (ores and roundwood) to processing sites [5].

2.2.3. Mining

Sweden's mining industry is vital to the country's economy, particularly in the north, where mining firms employ the majority of the workforce and where mining is considered as a primary driver of development [57]. In the EU, Sweden is one of the major producers of iron ore, lead and zinc, which are primary materials used for metallic ore production, building materials, industrial minerals, dimension stones and energy minerals [5,8]. According to the Swedish Association of Mines, Mineral and Metal Producers [58], the country's mines are important in the development of modern society as the minerals are used in car manufacture, tablets, phones, batteries and wind turbines, contributing to the green transition and Arctic globalization. However, most of the operating mines located in Northern Sweden are established in traditional reindeer herding lands. The Reindeer Herding Communities (RHC)—"A legal entity, constituting a geographical area, a form of economic association, and a social community between members" ([59] (p. 1))—have been against the expansion of current mining activities, that the Sámi Parliament [60] have called for an immediate stop of all new mining activities, including new exploration and mining concessions. Contrastingly, Sweden's current mineral strategy published in 2013 aims to increase the country's positive position and attitude towards the mining industry. Hence, land use conflicts are intensifying [5].

Mining and tourism can also have synergies, as the mine's investment on infrastructure (i.e., railroad, improved communication systems, etc.) and road network benefits tourists and it enables them to travel to the area. Some mining sites (i.e., Kiruna and Gällivare) also offer standardized tours and are considered to be tourist attractions. These activities boost tourist visits and increase the income of the municipality [61].

Conflicts and/or synergies between mining and energy development are discussed in Section 2.2.1 while forestry is discussed in Section 2.2.2.

2.2.4. Reindeer Husbandry

Reindeer husbandry is a general term that refers to reindeer pastoralism as a livelihood. It includes the underlying economic and cultural component of subsistence, as well as the social-ecological relationship between humans, animals, and the natural environment [31]. Reindeer herding, on the one hand, refers to the practical and operational parts of working with the reindeer, e.g., grazing, culling and marking of calves. Reindeer herding is an older concept and identified as part of the Sámi culture [62]. Reindeer husbandry has been declared as part of Sweden's national interest and preserving reindeer husbandry goes with preserving the Sámi culture [34]. Sámi reindeer herding is organized and managed separately by 51 RHCs [63]. RHCs have reindeer herding rights that cover approximately 55% of Sweden's land area. However, it is important to note that not all of this land is actively used for reindeer herding as it also includes urban areas, inaccessible mountain regions, and other unsuitable terrains [34]. Nevertheless, according to Sandström et al. [52], there are actually no areas exclusively reserved for reindeer husbandry because of overlapping land uses. Reindeer herding rights are based on usufructuary rights and conducted in conjunction with other land uses [34,64]. Land used for reindeer herding includes the productive forest lands, where forestry activities are allowed; therefore, overlapping land use is inevitable as the same land is being used for different purposes. Additionally, as mentioned in the above subchapters, mining, energy development and their associated infrastructures like roads, rails and built-in areas have impacts on reindeer husbandry as reindeers and the Sámi people are the most affected by any changes to the environment [5].

Conversely, reindeer herding requires extensive grazing areas, which can impact forest management practices. Prioritizing reindeer husbandry would reduce annual harvesting volumes because essential forest growth activities, such as fertilization and soil scarification, would be restricted to preserve ground lichens, a crucial food source for

reindeer [65]. However, in Northern Sweden, this is not the case as the forest industry is more dominant [65,66]. With regards to mining, wind energy and tourism development, reindeer herders can oppose industrial expansion into their traditional lands, and at times be successful in doing so. However, like the forestry sector, industrial development is prioritized and reindeer herding needs are either ignored or overridden [14,66–68].

More details about the conflicts with other sectors are discussed in Sections 2.2.1–2.2.3 and 2.2.5.

2.2.5. Tourism

Northern Sweden hosts small tourism companies and the majority of them specializes in nature-based tourism due to the several large protected areas that attract tourists from all over the world [69]. Tourists also come to Northern Sweden to experience what they call 'Arctic tourism', which is related to wilderness or the vast empty lands, sparsely populated regions, extreme environments, adventurous expeditions, and frozen and untouched landscapes [54]. Hiking, skiing, cycling, snow mobile, reindeer and husky safaris are the most attractive tourist activities in the north [5]. While the tourism industry is small in Northern Sweden, it has increased jobs and aided in the growth in the local community [69]. However, tourism competes with forestry and reindeer husbandry for the same space. Tourism impacts forestry by mechanical wear and tear of forest roads and trails. Motorized vehicles can cause soil erosion, soil compaction and reduction in the humus layer [5]. Slopes are also relatively more sensitive than flatter terrains. Regarding reindeer husbandry, tourists disturb the herd and their migration routes. Female reindeers are particularly more sensitive to disturbances during gestation period and calving season. Reindeer's avoidance of human activities pushes them to move away increasing their energy consumption and can endanger them, especially in winter, when food is limited [70]. On the one hand, research indicates that interaction with the reindeer constitutes a big part of the visitor experience as part of the Sámi culture. Tourism also increases awareness on Sámi culture and tradition. However, this creates conflict as the Sámi community is being marketed as exotic, primitive and simple. Involvement of the Sámi community in the creation of tourism-related activities has been repeatedly questioned [61,70]. Lastly, the existence of mines and wind turbines in Northern Sweden is the opposite of the wilderness or Arctic tourism experience that the tourism industry offers, most particularly for nature-based tourism, where activities tend to be on predominantly undisturbed rural land [67,69].

2.3. Data Collection and Analysis

To answer our research questions, we conducted a systematic literature review of journal articles regarding land use conflicts in Northern Sweden, particularly forestry, mining, tourism, reindeer husbandry and energy. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020, an updated guideline for reporting systematic reviews [71]. The guideline establishes a structured, transparent and completely reproducible process of literature review for identifying and appraising research relevant to our research questions [71].

2.3.1. Eligibility Criteria and Information Sources

The research work only dealt with land use conflicts in Northern Sweden among different economic activities such as forestry, mining, reindeer husbandry, tourism and energy. We applied no limitations on the year the studies were published, nor which techniques or concepts were used to gain the most comprehensive understanding of existing issues. However, we limited our search to only English articles that were peer reviewed.

We used two databases—Scopus and Web of Science—for our literature search carried out on 1 June 2023. Scopus by Elsevier and Web of Science by Clarivate are internationally recognized databases of peer-reviewed publications with a wide variety of disciplines that suited our research topic [72].

2.3.2. Search Strategy

From the databases, we define the primary search string to "land use" AND "conflict" AND "northern" AND "Sweden". However, the search returned with very few studies; therefore, we included secondary search strings relevant to the research topic, resulting in a total of 293 articles; see Table 1. We also used reindeer "herding" and "husbandry" to widen the search since both terms are used interchangeably often with different meanings. In this paper, we followed the definition as stated in Section 2.2.4.

Table 1. Primary and secondary search string for land use conflict in Northern Sweden.

Database	Search String	String	No of Articles Retrieved
Scopus	Primary	"Land use" AND "conflict" AND "northern" AND "Sweden"	20
	Secondary	"Forest" AND "conflict" AND "northern" AND "Sweden"	26
		"Mining" AND "conflict" AND "northern" AND "Sweden"	8
		"Tourism" AND "conflict" AND "northern" AND "Sweden"	8
		"Reindeer husbandry" AND "conflict" AND "northern" AND "Sweden"	15
		"Reindeer herding" AND "conflict" AND "northern" AND "Sweden"	8
		"Energy" AND "conflict" AND "northern" AND "Sweden"	10
Web of Science	Primary	"Land use" AND "conflict" AND "northern" AND "Sweden"	33
	Secondary	"Forest" AND "conflict" AND "northern" AND "Sweden"	80
		"Mining" AND "conflict" AND "northern" AND "Sweden"	16
		"Tourism" AND "conflict" AND "northern" AND "Sweden"	14
		"Reindeer husbandry" AND "conflict" AND "northern" AND "Sweden"	16
		"Reindeer herding" AND "conflict" AND "northern" AND "Sweden"	11
		"Energy" AND "conflict" AND "northern" AND "Sweden"	28
TOTAL			293

2.3.3. Selection and Data Collection Process

From the 293 articles retrieved in the previous step, we applied the inclusion and exclusion criteria (see Table 2) to make sure that the articles are relevant to answering our research questions. We used Rayyan.ai (www.rayyan.ai, accessed on 16 January 2023) [73], a collaborative systematic review application, to create an online central database, where we can immediately see the decision of each researcher. Rayyan.ai is not an automation tool and only hints on which articles can be included or excluded based on previous decisions. Following the AI suggestions is optional yet the authors worked independently on their decisions. Data collection and validation of the results, including summary and synthesis of the articles analyzed, were also conducted with the co-author.

The predefined criteria determined which articles will be included in the analysis. The result of the selection process is presented in Figure 2. In the initial stage, there were 293 records found together in Scopus and Web of Science databases. However, it should be noted that the use of secondary research strings provided multiple duplicates, e.g., 6 exact matches of 1 article were found after the search was conducted in the databases. After removing duplicates (121 articles), non-peer-reviewed articles, e.g., review articles, editorial pieces (2 articles) and non-English article (1), a total of 169 articles remained for the next stage. Titles and abstracts were read and those which are found not to be relevant were removed (117 articles). We compiled data on the article's publication year, publisher, journal published, organization, study location, conceptual approaches, methodologies, identified land use conflicts results and recommendations of analyzed articles. The remaining 52 articles were then retrieved, with only one record found to be inaccessible. After scanning the manuscript, only 33 articles remained and fulfilled all the inclusion criteria for our research study; see Appendix A for a complete list of included studies. To better illustrate the selection process, an article titled 'Swedish tourism and climate change mitigation: An

emerging conflict?' [74] might appear to meet all inclusion criteria as it is about tourism and conflict. However, upon reading the whole manuscript, the article determined carbon emissions of the tourism industry in Sweden and how to adapt mitigation measures to minimize emissions. It was excluded because there is no land use conflict per se.

Table 2. Criteria for inclusion or exclusion or articles retrieved in Scopus and Web of Science.

Criteria	Decision
Predefined keywords exist as a whole or in part in title, keywords and abstract	Include
Peer-reviewed article	Include
Published in English	Include
The study is about forestry, mining, reindeer husbandry, reindeer herding, tourism and energy land use	Include
Articles that are duplicated	Exclude
The study is not conducted in Northern Sweden	Exclude
The study is not about conflicting land use as defined in this study	Exclude
No access to article, e.g., not open access	Exclude
Papers that are not primary/original research	Exclude

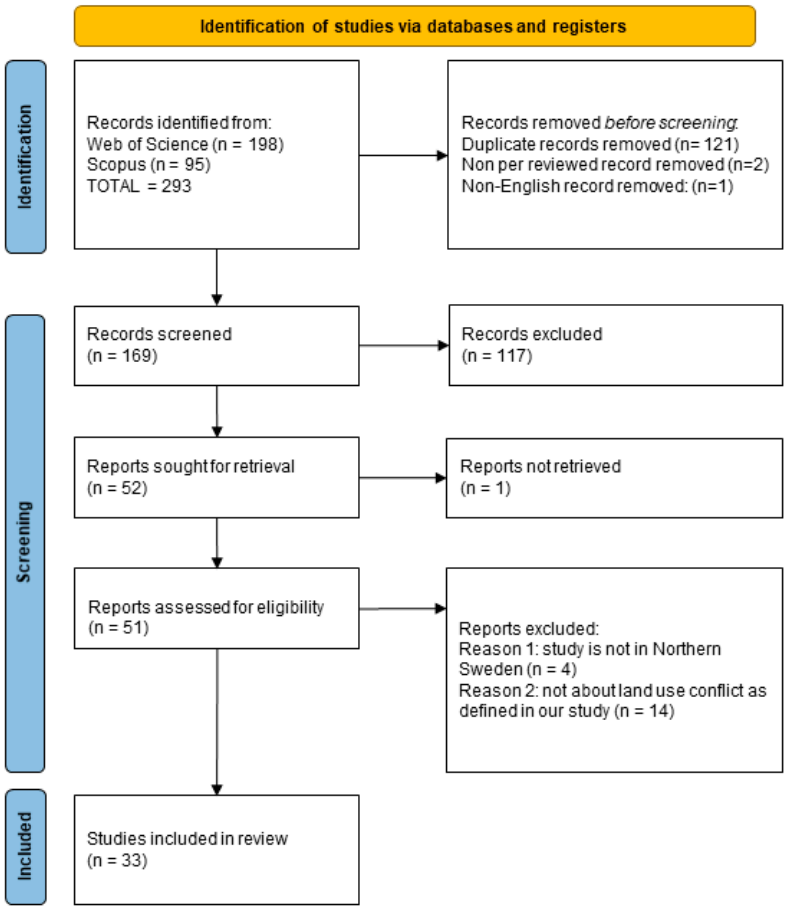

Figure 2. Result of the selection process using the PRISMA flow diagram for database search and appraisal of articles regarding land use conflicts in Northern Sweden.

2.3.4. Synthesis Method and Limitations

We used descriptive statistics and conducted thematic analysis on the 33 articles. The descriptive statistics provided a summary of the characteristics and distribution of the studies conducted regarding land use conflicts in Northern Sweden, including year of publication, affiliation and research organization of the first authors, location of the

study, concepts or theories used, methodologies applied, and results. Individual tables and figures were created with Microsoft Excel and Datawrapper and provided to summarize study characteristics.

The thematic analysis focused on the content of the articles in terms of conflict typologies, and suggestions on how to move forward. We conducted an inductive analysis to develop the organizing themes. Inductive analysis is a process wherein resulting themes are derived from the data or articles themselves and not from preconceived concepts or framework. In this paper, themes are repeated patterns of meaning derived from the texts [75]. To validate the thematic analysis and reduce researcher bias, we validated the result iteratively by extensive consultation and repeated revision until the themes evolve into an interpretation both the authors agree on. To provide more detail, during the initial phases of the analysis, each author independently scrutinized the texts. Subsequently, upon developing initial themes, the authors convened to compare and contrast their respective thematic developments. This process unfolded through a combination of face-to-face meetings and virtual discussions, wherein the authors deliberated on the accuracy of the themes in capturing the essence of the textual data. If discrepancies arose, adjustments were made to the thematic groupings, as well as to the names and definitions of the themes.

To determine the lessons learned and ways forward for land use conflicts in Northern Sweden, we identified key themes regarding typologies and causes of conflicts highlighted by the authors in their studies. Typologies of conflicts examine the dilemmas or underlying causes of various conflicts. The main themes for ways forward were derived from the overall results and corresponding recommendations provided by the authors of the reviewed research papers. Whether these solutions are effective is beyond the scope of this study.

Lastly, we are aware that there might be articles that cover land use conflicts in Northern Sweden that were not included in this review, and this may be due to the absence of the search string on their title, keywords or abstract and therefore far from the scope of this review work conducted. Additionally, it could be possible that there are articles about land use conflicts in Northern Sweden that are not indexed in Scopus and Web of Science.

3. Results

3.1. Bibliographic Summary of Analyzed Papers

Based on our literature review, land use conflicts between reindeer husbandry, forestry, hydropower and mining in Northern Sweden have existed for decades, but there are few studies published that focused on these topics. The first publication we found that is relevant to our research questions was dated 2000 and only one paper per year was published until 2015. By 2016, the topic got a little more attention and the number of articles increased to six published by 2022, its peak. Looking at the trend of article publication in 5-year intervals, there is an increasing trend in publication; see Figure 3.

Research is mostly performed in research organizations in Sweden (26 articles), neighboring Arctic countries such as Finland and Norway, Canada and USA; see Appendix B. The Swedish University of Agricultural Sciences, Umeå, was found to have the most articles published on the topic (16 articles) followed by the University of Umea (4 articles); see Appendix D. The highest number of articles was published with Elsevier (8 articles), Taylor and Francis (8 articles) and Springer (6 articles); see Appendix D. These trends have implication on the context and interests related to the research topic.

All of the articles have at least one study location in Northern Sweden, and a few articles (4 of 33 or 12%) have more than one study location not only in Sweden but also in other countries such as Finland, Canada and Norway; see Figure 4. Out of the 33 articles, only 8 articles indicated Northern Sweden as their exclusive study site—these articles either conducted spatial analysis, inventory or regional-level analysis. For the articles that have specified their study locations from the regional or county level down to the municipality level, we found that the majority of the studies included Norrbotten county (16 of 33 or 48%), while Västerbotten county was studied in (11 of 33 articles); and Jämtland (2 articles) and Västernorrland (1 article) were studied less. At the municipality level, Jokkmokk in

Norrbotten is the most studied location (9 of 33 articles), while Vilhelmina is the most studied municipality in Västerbotten (3 of 33 articles).

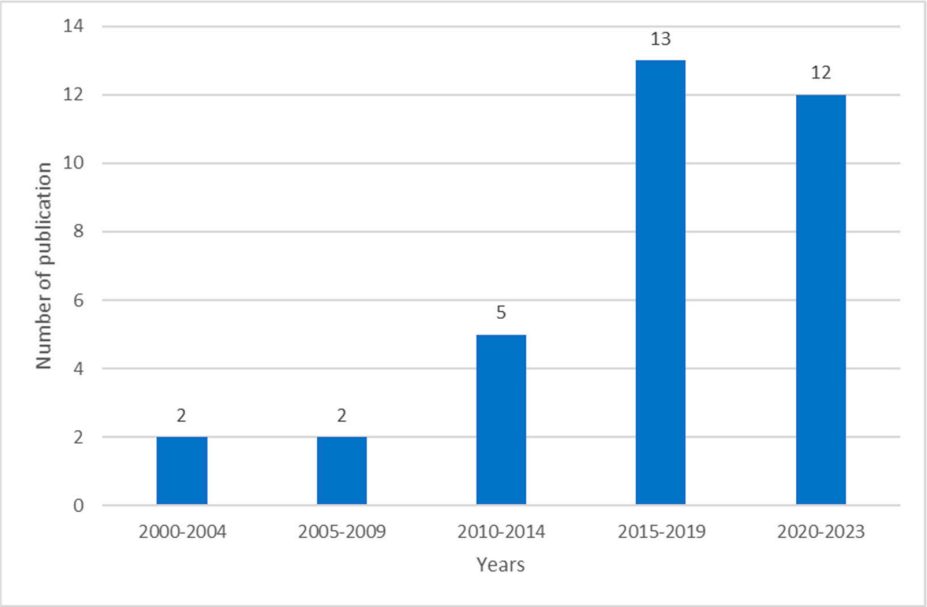

Figure 3. Number of publications from 2000 to 2023 regarding land use conflicts (among reindeer husbandry, forestry, hydropower and mining) in Northern Sweden; source: Scopus and Web of Science, 2023.

We also looked into the land uses in conflict in the 33 articles focused on or compared to gain a better understanding of the problems tackled in the articles. A total of 19 out of 33 articles compared forestry to other land uses, out of which 11 articles analyzed forestry and reindeer husbandry, which was the most studied land use conflict in the reviewed papers. Mining followed with six articles, two of which looked into mining and indigenous people's land use conflict. Surprisingly, there are no articles retrieved in this systematic review about land use conflict with the energy sector—either wind energy or hydropower—while tourism was compared to other land uses four times. Additionally, a total of 22 articles looked at two competing land uses, while only 3 articles looked at 3 to 4 competing land uses simultaneously; and 8 articles looked at land use conflicts within the same economic activity, e.g., different forest management regimes.

The review of methodologies used gave us insights into how authors explain and understand land use conflicts, including the tools and practices they employed to answer their research questions. This helped us understand the problems posed within each article and determine lessons learned. We found that 20 articles used qualitative analysis, 9 mixed methods and only 4 used quantitative methods. Articles which used qualitative methods primarily conducted interviews and focus groups to gain information on the complexities of land use conflicts. Mixed methods also used interviews, observations and workshops but were accompanied with statistics, spatial and Geographical Information Systems (GIS) analysis. Quantitative studies used GIS and forest inventory data exclusively for their analysis. Most of the articles conducted a case study approach (16 of 33 or 48%) followed by comparative case study (5 of 33 or 15%). Participatory research was used in four articles, where researchers collaborated with relevant stakeholders to address and interpret land use conflict [77]. Historical analysis (3 of 33 or 9%) was used to address present problems by looking at the past, while scenario analysis (3 of 33 or 9%) was used to look at a possible and plausible future. Only a few studies conducted purely statistical (1 article) and spatial analysis (1 article).

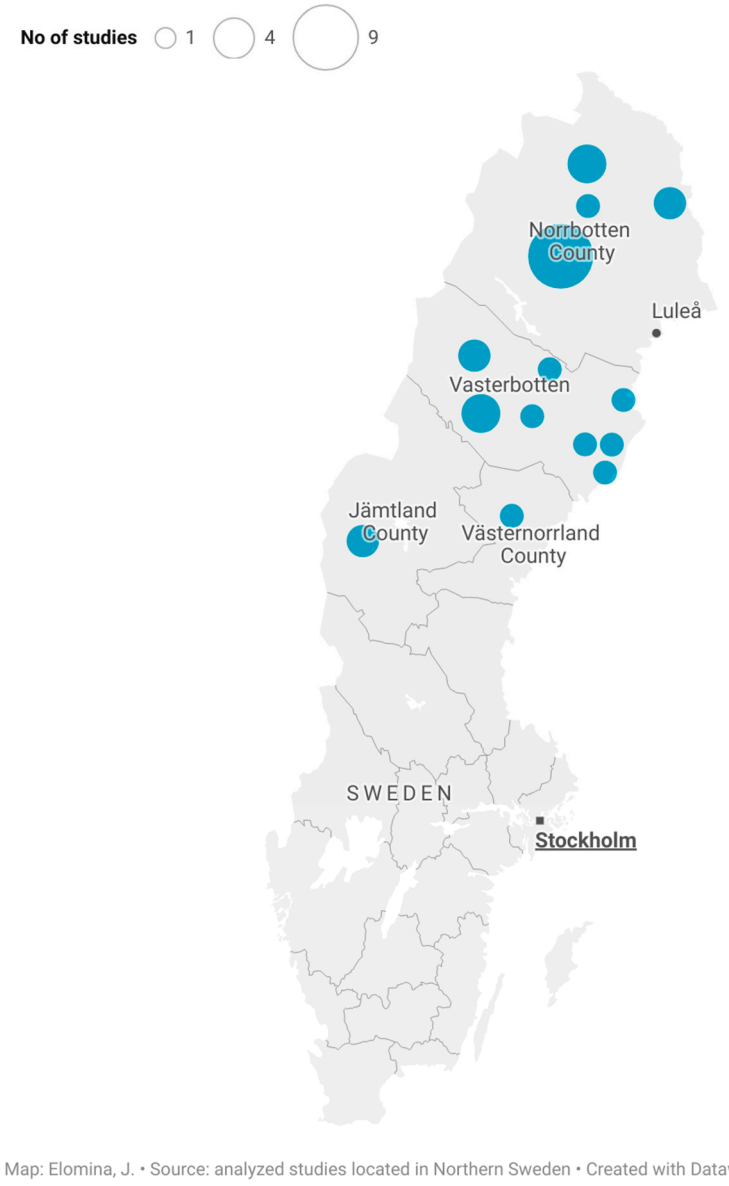

Figure 4. Study locations of the articles analyzed in Northern Sweden [76] created with Datawrapper by Elomina, J., reprinted with permission from Datawrapper based on Terms of Service.

Almost all 33 articles employed a different concept or theory in their analysis, with the exception of the transaction costs concept, which was used twice. Most of the theories that were used focused on gaining a deeper understanding of land use conflicts by looking at different perspectives, interpretations and understandings of different stakeholders. Some applied a more pragmatic approach by collaborating with stakeholders and assisting them in addressing land use conflicts. A detailed list of methods and theories found in the papers is presented in Appendix E.

3.2. Lessons Learned: Typologies and Causes of Land Use Conflicts

Based on our thematic analysis of the analyzed papers, we identified three typologies of conflicts—access, development and management—as well as their causes (see also Table 3):

1. Conflicts regarding access stems from competing claims over land use and shared utilization of resources. These conflicts are subdivided into two subtypes: land rights and sharing of resources. Conflicts on land rights include user rights vs. ownership

rights (A2, A22, A31). In northern Sweden, the law guarantees the rights of reindeer herders to use land for reindeer herding, hunting and fishing but forest lands are privately owned, therefore creating land use rights imbalance (A26, A27, A32). In line with this is the subtype sharing of resources, as reindeer herders share not only the land but also other resources such as water, berries, mushrooms and lichens that grow in the forest that are important reindeer food (A33, A25, A10, A15).

2. Conflicts about development refer to the conversion of the traditional lands to industrial use and their potential risks and impacts to the local community. Although very much discussed in all papers, it is the least likely reason for land use conflict in the articles analyzed. Land use conflicts regarding development involve industry establishment (A3, A4, A16), e.g., mining and its potential cause of socio-ecological transformation as well as the dependency of communities on exploitative industries, that might be unsustainable in the long term (A1, A5). Tourism development is also discussed specifically on issues regarding destination development and showcasing a specific part of the Sámi culture, e.g., reindeer herders or indigenous people culture (A23).
3. Conflicts about management mostly refer to the divergent priorities, practices and interpretation of the plans and policies. Land use conflicts regarding management are the most discussed (17 articles) and divided into two subtypes—institutional and resource management. Based on the articles, one of the reasons for land use conflicts is the political or institutional differences in the interpretation of policies and management objectives of stakeholders, especially the influential ones (A19, A20, A21, A24). It focuses on the role of institutions like the state and city administrators in the land use conflict in terms of the decision making and how it affects the implementation of policies and regulations (14, A8, A6). On resource management, the main reason is the differences in practices, mostly in forestry (A7, A11, A13, A9, A29, A30). The kind of forestry restoration, regime and management affects not only the productivity of the forest sector itself but also reindeer husbandry, hunting, tourism, nature protection and water quality (A18, A12, A17, A28).

Table 3. Typologies of conflicts and problem source.

Typologies of Conflicts	Subtypes	Problem Source	Count
Access			
	Land Rights	Reindeer herders have usufructuary rights while industries have ownership rights	6
	Resource Sharing	Parallel use of same resources, e.g., river, forest ecosystem services	4
Development			
	-	Current and potential effects of industry establishment and expansion on society and culture	6
Management			
	Institutional	Conflicting interpretation and objectives of stakeholders	7
	Resource	Conflicting practices, management regimes that affect resource quality and use	10
Total			33

3.3. Suggested Ways Forward

Based on the thematic analysis of the papers analyzed, we found five main ways to move forward with regard to land use conflicts in Northern Sweden: (1) broader understanding of different stakeholders' perception; (2) acknowledging traditional knowledge; (3) local involvement and participation; (4) improved understanding of stakeholder incentives and losses; and (5) recognizing stakeholders' roles in Sámi traditional land's colonial history, as detailed below:

3.3.1. Broader Understanding of Different Stakeholders' Perception

Conflicts are beyond the resource but it is the different interpretation, understanding and perception of place or meanings, sustainable development and policies of the stakeholders that explains and fuel the conflicts (A4, A3, A19, A5, A1). Differences in perception of stakeholders affects the formulation of a common target either in reaching agreements or in developing policies. Additionally, reflecting and considering how other parties understand the conflict can also provide venues for better communication (A14, A24). The authors suggest as a way to move forward is to have a broader understanding of different stakeholders' perception and expectations regarding the resource use and conflict resolution. Better deliberation and quality of communication between parties can be difficult to achieve but necessary (A12). Lastly, stakeholders as well as researchers should understand that perception is intertwined with social organization and place attachment (A3).

3.3.2. Acknowledging Traditional Knowledge

Current governance and resource management are not successful in fostering the needs of reindeer husbandry and the heterogenous forest management schemes that they require (A10, A16, A18). Additionally, stakeholders should also be aware that each silvicultural measure modifies the landscape and affects reindeer herding potential (A7, A25, A27). One the one hand, land use conflicts in Northern Sweden are so complex that it is challenging to find synergies and minimize tradeoff between economic activities that use the same landscape (A11, A20). Despite these, analyzed papers suggest that acknowledging traditional knowledge and incorporating them in current resource management are crucial for reindeer herders and industries to co-exist. There is also a need for a context-specific land use planning that aims to align wildlife and diverse land uses, as well as lifting the scale of management from stand level to landscape level to gain a better overview of the interactions among the industries and indigenous peoples' use of land (A7). Lastly, the Swedish state needs a profound rethinking of their regional development vision and to be clear and concise about their plans without leaving peripheral regions on their own (A8, A11).

3.3.3. Local Involvement and Participation

Participation of different stakeholders in decision making and developing management plans is a viable option for handling the complexities of land use conflicts (A21, A28). Local involvement and participation are critical to resolve land use conflicts or minimize tradeoffs between industries. Using participatory mapping provides an opportunity to find real and practical solutions where parties are satisfied with how the land should be utilized (A21). Bringing together indigenous knowledge and advanced technology an in interactive process can be a better basis for negotiation and resolution (A21, A28, A29).

3.3.4. Improved Understanding of Stakeholder Incentives and Losses

Participation in consultations and negotiations needs time and money associated with transaction and opportunity costs, and the Sámi are the most negatively affected, resulting in uneven relations (A32, A33). Transaction costs are expenses associated in negotiations, and this includes expenses incurred by participating in a meeting and the associated travels costs, daily meals and the income forgone due to leaving the workplace. Reindeer herders are the most affected as they should leave their reindeer herding activity to attend a day of meeting more commonly held in the cities (A32). On the one hand, mining and

forestry industry representatives are paid while being in the negotiations and their travels costs are paid for by the company (A32). Additionally, as GPS trackers are found to be helpful on reindeer herding, there is an associated costs with it and sometimes the costs are greater than the benefits (A31). There are also associated tradeoffs with using new technology for herding such as forgetting traditional way of herding (A31). The authors suggest that improved understanding of the stakeholder incentives and losses with regard to their participation in changing current governance and management is crucial (A33). Even distribution of at least the transaction costs among stakeholders is needed to ensure efficient institutional arrangement (A32, A33).

3.3.5. Recognizing Stakeholders' Roles in Sámi Traditional Land's Colonial History

The importance of acknowledging Sámi colonial history and the major challenges rooted into the ethno-political discourses of land use conflicts are emphasized (A9, A22, A23), including how the Swedish state and industries pursue their green growth agenda even to the detriment of nomadic forms of life, Sámi culture and reindeer husbandry (A30, A6). The authors suggest ways to move forward: the state, the majority and the industries should recognize their role in the colonial history in Sámi traditional lands, and the power relations among them (A9, A30); to integrate traditional knowledge into the current system which is seen to overemphasize the Western knowledge system in designing policies and management plans (A9). An example of this is the Laponia WHS management model that illustrates clear ambition from both public and private stakeholders to develop sustainable management for Sámi's natural and cultural heritage (A30). Recognizing these issues and dealing with them are important not only for the Sámi, but also for all other indigenous groups and minorities in the Arctic; and wherever such conflicts appear.

4. Discussion

In this paper, we conducted a systematic literature review to uncover insights into the types and causes of conflicts described in the literature on Northern Sweden, as well as to identify potential pathways for future resolution strategies and research.

This literature review shows that there are few studies about land use conflicts and SLU, Umeå has been leading the research efforts, which is unsurprising, since they are located in Northern Sweden and their research goals are aligned with land use conflicts of reindeer husbandry and forestry. This may also be the reason why forestry and reindeer husbandry are the most studied land use conflict in Northern Sweden. Other land uses, e.g., nature protection, recreation and heritage, are not considered competing land use per se since they are not an economic activity. However, reviewed studies included them because of competing interest in the forest. With Natura 2000, nature protection is being seen as an overlapping land use with forestry because by law, Sweden has to set aside forest areas strictly for protection and conservation [78]. However, recreation and heritage in the forest are every man's rights in Sweden and conflict between forest owners and visitors is low due to the public's strong awareness of the need to avoid conflict to sustain public access (A27).

Furthermore, based on this review, land use conflicts between economic activities are addressed unequally. The energy sector is very much underrepresented in this study, and this is partly because existing studies are either not indexed in the database that we used, or scholars used different terms. We found this to be critical as the energy sector is one of the sectors that is intensifying conflicts in Northern Sweden due to the increased demand for renewable energy sources. On the one hand, there may be other factors that could explain the distribution of the studies, for example the interest of the researchers and available funding.

Additionally, it is possible that land use conflicts in other sectors are not dubbed as land use conflict per se because, as mentioned in the introduction, land use conflict can be vague as a research topic and encompasses various types of conflict: spatial versus social, cultural versus political. There are also several related terms like environmental conflict, natural resource management conflict, common pool resource conflict, and intractable

natural resource conflict [6,79]. Other scholars prefer to focus on conflict resolution (e.g., A26, A28, A31) and cumulative impacts of the industries on reindeer husbandry and other land uses [80,81], and while these papers are clearly relevant to the discussion, they are beyond the scope of the systematic literature search in this study. On the one hand, we do not call for a common terminology as we acknowledge how complex and multidimensional land use conflicts can be, but we support the recommendations of Fienitz [6] in arguing that there should be a general criterion that accommodates different conceptual approaches, whether spatial, social, normative or political land use conflict.

This review also revealed that most studies are conducted in Norrbotten county. This is because most of the extractive industries are built in the area and it is where land use conflicts are most apparent, particularly with reindeer husbandry and the Sámi community. Out of the 51 RHCs in Sweden, Norrbotten hosts the majority, with 32 RHCs [63]. It is also considered to be the cradle of the green transition and where expansion of industries is imminent [42,49]. This suggests that while research in other counties is also important, we can still make the case that Norrbotten needs additional research because of the intensifying conflicts and the under-representation of studies on energy land use in the region. In addition, as only one study reviewed herein compared four different land uses (A28)—forestry, reindeer husbandry, mining and tourism—it stands that a complete overview of the effects of different industries, especially the energy sector, to reindeer husbandry, various indigenous and local community is also needed.

The methodologies used to study land use conflicts in Northern Sweden provided us with an understanding of how authors explain and understand the problem, as well as to explore the potential and limitations of different kinds of approaches. We found that most of the articles conducted qualitative case studies using different conceptual approaches. This is particularly true for conflicts about access to the land, which includes land rights and sharing of common pool resources. On the other hand, some studies used GIS and remote sensing as a way to address land use conflicts. Contrary to this, Comber et al. [24] argued that using land cover maps as proxy for land use is ineffective and there can be various errors since land use cannot be inferred from land cover, especially when the land in study is being used for reindeer grazing, where there are not many indicators to categorize a piece of land that is specifically used for it. However, there has been several technological changes and advancement to land cover/land use studies that conducted evaluation and uses other data proxies to confirm land use. One case is a study by Stoessel et al. [7], where for the first time, they mapped a spatial baseline of the various land use, climate and predator pressures affecting reindeer grazing in the northern parts of Sweden and other countries of Fennoscandia. They were able to show that 85% of the land in the North is affected by at least one land pressure and 60% is affected by multiple sources of land use pressure coming from different industries, climate change and predators. Additionally, studies that used remote sensing and GIS are helpful in determining migration routes and grazing areas [77]. However, further research should also focus on other land uses of particular importance for all indigenous people, either culturally, environmentally or socially, and not only on land use of reindeer herders. Furthermore, it is more crucial to promote coproduction research and participatory, transdisciplinary approaches to ensure that diverse perspectives and knowledge systems are integrated, leading to more comprehensive and effective solutions to land use conflicts.

Aside from spatial-based solutions, some of the articles analyzed in this paper tried to address the conflict through a pragmatic approach by collaborating with stakeholders. These articles aimed to facilitate the negotiations and discussions among stakeholders to bridge understanding and mutual education. According to Dukes [28], it is the relational by-products of conflict negotiations that are more appreciated by the stakeholders involved, because it brings about openness, flexibility and inclusion of stakeholders with different and even conflicting perspectives.

As our analysis suggests, researchers have employed a diversity of methodological approaches to study land use conflicts, indicating that there is no singular way to comprehend

the complexities of these conflicts. Furthermore, it implies that for the long-standing land use conflicts in Northern Sweden, which have persisted for centuries, there is no one-size-fits-all solution that can adequately address and resolve the multifaceted issues at hand.

4.1. Lessons Learned

Regarding the lessons learned from the typologies and causes of conflicts, we found three main themes: First, access conflicts, which stem from competing claims over land use and shared utilization of resources. Analyzed articles focused on user rights and ownership rights, particularly reindeer herders' rights to grazing as a customary practice, compared to the rights of the land owners. Typically, ownership rights are stronger and give the owner more control and power over the land, but this is more complicated in Northern Sweden due to state laws about land use, e.g., the Minerals Act (in Sweden, anyone intending to explore or mine a mineral deposit may be granted a permit to do so under the Minerals Act, regardless of who owns the land [82]), the Forest Act (forest owners have an obligation to take in consideration reindeer husbandry, where it is allowed, through adjusting the size and location of the harvesting site when needed as well as in constructing forest roads [83]), the Reindeer Husbandry Act (secures reindeer herding as an exclusive right for the Sámi people of Sweden [84]), and international conventions protecting traditional land use, such as the UN Declaration on the Rights of Indigenous Peoples [85], National Minorities and Minority Languages Act [86], UNDG Guidelines on Indigenous Issues [87] to name a few. Second, development conflicts refer to the conversion of the traditional lands to industrial use such as mining, forestry, and tourism. Additionally, these are also the potential impacts and risks of certain development on local communities and indigenous people. It appears that balancing development, socioecological systems and traditional livelihoods is at the core of this conflict typology. Third, management conflicts revolve around reconciling the divergent priorities of institutions and resource managers with the livelihoods and interests of various stakeholder groups, all of whom are impacted by management decisions and resource utilization strategies employed within the region. These conflicts are not necessarily mutually exclusive and instead overlap in complex ways. However, they largely depend on the authors of the articles analyzed for this study, which conflict type to emphasize, explain and understand so as to provide a better picture of local realities. This is consistent with Dukes' [28] claim that conflicts are a subset of a much larger public conflicts that involves ethnicity, power dynamics, economic development and governance. Land use conflicts are often a combination of these issues. Additionally, we also raise Dunk et al.'s [21] findings that land use conflicts may also progress from one to another without notice, especially when studied in isolation. Understanding that these conflicts do not operate in isolation is crucial in understanding the situation in Northern Sweden and in designing conflict resolution strategies, if it is even applicable.

Among the three identified typologies of conflicts, access types are considered intractable or wicked, because they involve common pool resources [64]. Wicked problems are multifaceted and are difficult to tackle because stakeholder values are intricately linked to the nature of the problem. Each stakeholder has their own interpretation of problems and solutions; therefore, even the definition of the problem is contested and solutions are not simply right or wrong [88]. As an example, the condition in Northern Sweden, wherein reindeer herders have usufructuary rights to grazing while the forests are privately owned. They use the same land and have rights to use them. The problem has existed for more than a century and still has not been resolved today [51]. We support the findings of Johansson et al. [89], who argued that natural resource management conflicts that turn to resolve conflicts through deliberations hardly resolves the case and meta consensus is one way to start resolving conflicts.

4.2. Ways Forward

Results show that for some articles, there is a disconnect between the typologies and causes of conflicts to the ways forward proposed. As in most cases, research is performed

using test methods or theories as a way to explore the possibilities of solving the conflict or obtaining different perspectives on the problem (A3, A4, A24). Some articles conducted conflict assessment, wherein authors analyzed underlying problems and have an in-depth understanding of different perceptions, interpretation and views of different actors on land use conflict (A1, A2, A3, A5, A6, A15, A22, A24, A25). These methods of course do not directly resolve conflict and it is not the aim of the individual papers. But methods of understanding the problem by exploring different perspectives address the root cause of the problem and provide a better overview of the what the problem is really about. Therefore, transparent decisions and resolutions can come after.

On the other hand, others focused on mediation/facilitation between stakeholders (A7, A9, A11, A19, A20, A23, A27). Facilitation is where an external third party or facilitator such as research organizations help stakeholders have constructive discussions about the conflict. A facilitator may also provide assistance in effective communication and developing better relationships (i.e., improve levels of trusts) among stakeholders [28,90]. This type of approach, however, has more pragmatic suggestions and their recommendations are related to the problems they posed.

Finally, as we aim to determine the ways forward for land use conflicts in Northern Sweden, we identified five main ways to move forward. However, it all boils down to understanding the root cause of the conflicts and seeking out all the parties involved and engaging in a transparent, inclusive and direct communication. Most of the articles we reviewed agree on two things: (1) there should be a broader understanding of the underlying interests and stake of the different stakeholders; and (2) there should be an inclusive, more participatory approach to discussing potential solutions, not to create an agreement but to come to an understanding. While we find that the suggested ways forward are not necessarily in conflict with each other, as some may even complement each other, there are some potential tensions or challenges in harmonizing and implementing all of the recommendations concurrently. In particular, while advocating for a broader understanding of different stakeholders' perceptions and traditional knowledge, actually integrating these diverse viewpoints and knowledge systems into policy making and resource management may be difficult in practice. Promoting local involvement and participation is laudable, but ensuring meaningful participation from indigenous communities and equitably distributing the costs/incentives of such participation processes remains a challenge. Recognizing the colonial history, power imbalances, and role of the state/industries is critical, but may make building trust and finding collaborative solutions more difficult, at least initially. Proposals for context-specific land use planning and scaling up management seem pragmatic, but could face hurdles in implementation given the complexities and potential resistance from some stakeholders. Some authors note that the state needs a rethinking of its development visions, but this may conflict with certain industries' priorities if not performed carefully.

In summary, operationalizing the suggested ways forward in a coherent, balanced manner that satisfies all stakeholders could be very challenging given the deep-rooted historical grievances, power asymmetries, and socio-economic factors involved. An integrated approach promoting intercultural dialogue, equitable policies, robust impact assessments, and meta-consensus building may help harmonize and incrementally advance these goals. But given the complexities highlighted, fully reconciling all recommendations may require sustained long-term commitment from all parties involved.

Finally, this systematic literature review maybe considered too narrow as it only focused on Northern Sweden. It did not include other sources or articles outside the scope of review and other terminologies similar to land use conflicts, hence there are results—conflict types and resolutions, and recommendations—that we were not able to include in our analysis that bear proper consideration. We would also want to highlight that the typologies and causes of conflict identified are not exhaustive and our results can be further elaborated by adding more studies and different cases. Additionally, there are some limitations to the inductive analysis conducted in terms of the repeating themes of the results, lessons learned and ways forward. Inductive analysis depends on the researcher's

knowledge and expertise and might be difficult to replicate. However, to minimize the risk of researcher bias, the authors validated the themes and the results iteratively by repeated and comprehensive consultation of result interpretation.

5. Conclusions

The objective of this paper was to provide an up-to-date review of land use conflicts research in Northern Sweden and determine lessons learned and the ways forward. Our systematic review and analysis revealed knowledge gaps as well as points of agreement among the articles analyzed. Thus, this paper has the potential to contribute to the formulation of future studies and in approaching conflict resolution, such as calling for more studies with regard to the potential of the energy sector to intensify land use conflicts with reindeer husbandry and the local communities. Additionally, another land use that should be explored is infrastructure development, particularly roads and railroads that go through the lands used for reindeer herding. According to Sweden Post [91], approximately 10,000 reindeers were killed in the past five years in the E10, a highway that goes through the lands used for reindeer herding. The E10 is also being used by the different industries to transport their goods and resources from the north to the south and vice versa. These infrastructures intensify conflicts, especially with reindeer husbandry and nature protection.

This paper stands as a significant contribution to the ongoing discourse on land use conflicts in Northern Sweden, offering insights into knowledge gaps, commonalities, and areas necessitating further investigation. The highlighted conflicts related to the energy sector and infrastructure development, notably roads and railroads, underscore the immediate need for comprehensive studies and policy considerations. Importantly, while this systematic literature review focused specifically on Northern Sweden, its findings bear relevance to a broader context. The issues identified and lessons learned can inform land use policies not only in the Arctic region but also in other areas facing similar challenges arising from resource demands and economic development. By drawing attention to the specificities of land use conflicts in Northern Sweden, this study serves as a microcosm that enriches the understanding of broader global dynamics, emphasizing the need for nuanced and context-specific approaches to land management and policy formulation.

Author Contributions: J.E.: Conceptualization; Methodology; Data synthetizing, Analysis; Visualization; Writing—original draft, review and editing. I.Ž.: Conceptualization; Methodology; Analysis, Writing—reviewing and editing. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Table A1. List of 33 articles analyzed.

No	Authors	Title	Year	Journal	Publisher
A1	Accastello, C. Bieniasz, A. Blasko, R. Lula, M. Pszenny, D. Sallustio, L. Simunovic N. Vosvrdova, N. and Speelman, E.N.	Conflicting Demands on the Natural Resources in Northern Sweden: A Participatory Scenario Development Study	2019	Journal of Environmental Assessment Policy and Management	World Scientific

Table A1. *Cont.*

No	Authors	Title	Year	Journal	Publisher
A2	Andersson, E. and Keskitalo, E.C.H.	Technology use in Swedish reindeer husbandry through a social lens	2017	Polar Geography	Taylor and Francis
A3	Beland Lindahl, K. Baker, S. and Waldenström, C.	Place Perceptions and Controversies over Forest Management: Exploring a Swedish Example	2013	Journal of Environmental Policy and Planning	Taylor and Francis
A4	Beland Lindahl, K. Johansson, A. Zachrisson, A. and Viklund, R.	Competing pathways to sustainability? Exploring conflicts over mine establishments in the Swedish mountain region	2018	Journal of Environmental Management	Elsevier
A5	Bystrom, Joakim	Mining tourism in abandoned and existing mines in the Swedish Far North	2022	Polar Record	Cambridge University Press
A6	Du Plessis, Gitte	Killing Reindeer: A Spatial Analysis of Nordic States and Nomadic Forms of Life in the Arctic	2020	International Political Sociology	Oxford University Press
A7	Eggers, Jeannette Raty, Minna Ohman, Karin and Snall, Tord	How Well Do Stakeholder-Defined Forest Management Scenarios Balance Economic and Ecological Forest Values?	2020	Forests	MDPI
A8	Haikola, S. and Anshelm, J.	Evolutionary governance in mining: Boom and bust in peripheral communities in Sweden	2020	Land Use Policy	Elsevier
A9	Hallberg-Sramek, I. Nordström, E.-M. and Priebe, J. Reimerson, E. Mårald, E. and Nordin, A.	Combining scientific and local knowledge improves evaluating future scenarios of forest ecosystem services	2023	Ecosystem Services	Elsevier
A10	Horstkotte, T. Sandström, C. Moen, J.	Exploring the multiple use of boreal landscapes in Northern Sweden: The importance of social-ecological diversity for mobility and flexibility	2014	Human Ecology	Springer
A11	Horstkotte, Tim Lind, Torgny and Moen, Jon	Quantifying the Implications of Different Land Users' Priorities in the Management of Boreal Multiple-Use Forests	2016	Environmental Management	Springer
A12	Johansson, A. Lindahl, K.B. and Zachrisson, A.	Exploring prospects of deliberation in intractable natural resource management conflicts	2022	Journal of Environmental Management	Elsevier

Table A1. *Cont.*

No	Authors	Title	Year	Journal	Publisher
A13	Karvemo, Simon Bjorkman, Christer Johansson, Therese Weslien, Jan and Hjalten, Joakim	Forest restoration as a double-edged sword: the conflict between biodiversity conservation and pest control	2017	Journal of Applied Ecology	Wiley-Blackwell
A14	Kløcker Larsen, R. and Raitio, K.	Protected areas and indigenous rights in Sápmi: an agonistic reading of conflict and collaboration in land use planning	2022	Journal of Environmental Policy and Planning	Taylor and Francis
A15	Koch, P. and Miggelbrink, J.	Being in the frontline of a Sámi culture and a private business: Cross-border reindeer herding in northern Norway and sweden	2011	Nomadic Peoples	White Horse Press
A16	MacPhail, Fiona Lindahl, Karin Bel and Bowles, Paul	Why do Mines Fail to Obtain a Social License to Operate?: Insights from the Proposed Kallak Iron Mine (Sweden) and the Prosperity/New Prosperity Gold-Copper Mine (Canada)	2022	Environmental Management	Springer
A17	Mancheva, Irina	Which factors spur forest owners' collaboration over forest waters?	2018	Forest Policy and Economics	Elsevier
A18	Neumann, Wiebke Levers, Christian Widemo, Fredrik Singh, Navinder J. Cromsigt, Joris P. G. M. and Kuemmerle, Tobias	Hunting as land use: Understanding the spatial associations among hunting, agriculture, and forestry	2022	Ecology and Society	Resilience Alliance
A19	Neumann, Wiebke Sandstrom, Camilla and Holmgren, Lina and Ericsson, Goeran	Defining a mountain landscape characterized by grazing using actor perception, governmental strategy, and environmental monitoring data	2019	Journal of Mountain Science	Springer
A20	Nilsson, Hilma Nordstrom, Eva-Maria and Ohman, Karin	Decision Support for Participatory Forest Planning Using AHP and TOPSIS	2016	Forests	MDPI
A21	Nordstrom, Eva-Maria Eriksson, Ljusk Ola and Ohman, Karin	Integrating multiple criteria decision analysis in participatory forest planning: Experience from a case study in northern Sweden	2010	Forest Policy and Economics	Elsevier
A22	Ojala, Carl-Gosta and Nordin, Jonas M.	Mining Sápmi: Colonial Histories, Sámi Archaeology, and the Exploitation of Natural Resources in Northern Sweden	2015	Arctic Anthropology	University of Wisconsin Press

Table A1. *Cont.*

No	Authors	Title	Year	Journal	Publisher
A23	Olsen, L.S.	Sámi tourism in destination development: conflict and collaboration	2016	Polar Geography	Taylor and Francis
A24	Roos, U. Lidestav, G. and Sandström, S. and Sandtröm, P.	Samrad: an institutional arrangement in the context of forestry and reindeer husbandry in northern Sweden	2022	International Forestry Review	Commonwealth Forestry Association
A25	Roturier, Samuel and Roue, Marie	Of forest, snow and lichen: Sámi reindeer herders' knowledge of winter pastures in northern Sweden	2009	Forest Ecology and Management	Elsevier
A26	Sandström, P Pahlen, TG Edenius, L Tommervik, H Hagner, O Hemberg, L Olsson, H Baer, K Stenlund, T Br, LG and Egberth, M	Conflict resolution by participatory management: Remote sensing and GIS as tools for communicating land-use needs for reindeer herding in northern Sweden	2003	Journal of Forest Research	Taylor and Francis
A27	Saito, Haruo Mitsumata, Gaku Bergius, Niclas and Shimada, Daisaku	People's outdoor behavior and norm based on the Right of Public Access: a questionnaire survey in Sweden	2023	Forest Policy and Economics	Elsevier
A28	Sandström, C. and Widmark, C.	Stakeholders' perceptions of consultations as tools for co-management—A case study of the forestry and reindeer herding sectors in northern Sweden	2007	Ambio	Springer
A29	St John, Rachel Ohman, Karin Toth, S or F. Sandstrom, Per, Korosuo, Anu and Eriksson, Ljusk Ola	Combining spatiotemporal corridor design for reindeer migration with harvest scheduling in Northern Sweden	2016	Scandinavian Journal of Forest and Research	Taylor and Francis
A30	Stjernstrom, Olof Pashkevich, Albina and Avango, Dag	Contrasting views on co-management of indigenous natural and cultural heritage—Case of Laponia World Heritage site, Sweden	2020	Polar Record	Cambridge University Press
A31	Valinger, E. Berg, S. and Lind, T.	Reindeer husbandry in a mountain Sámi village in boreal Sweden: the social and economic effect of introducing GPS collars and adaptive forest management	2018	Agroforestry Systems	Springer

Table A1. *Cont.*

No	Authors	Title	Year	Journal	Publisher
A32	Widmark, Camilla	Bargaining costs in a common pool resource situation—the case of reindeer husbandry and forestry in northern Sweden	2019	Canadian Journal of Forest Research	Canadian Science Publishing
A33	Widmark, Camilla and Sandstrom, Camilla	Transaction Costs of Institutional Change in Multiple-Use Commons: The Case of Consultations Between Forestry and Reindeer Husbandry in Northern Sweden	2012	Journal of Environmental Policy & Planning	Taylor and Francis

Appendix B

Figure A1. Countries of first Authors who conducted research in Northern Sweden [92]. Created with Datawrapper by Elomina, J., reprinted with permission from Datawrapper based on Terms of Service. Sizes of the circles corresponds to the number of studies conducted on land use conflict in Northern Sweden per first Author's country.

Appendix C

Table A2. Country and corresponding research organizations that studied land use conflict in Northern Sweden.

Country and Organization	No of Articles
Canada	1
University of Northern British Columbia	1
Denmark	1
Aalborg University	1
Finland	1
Tampere University	1

Table A2. *Cont.*

Country and Organization	No of Articles
Germany	1
Leibniz Institute for Regional Geography	1
Italy	1
University of Turin	1
Norway	1
Nord University	1
Sweden	26
Linköping University	1
Lulea University of Technology	2
Swedish University of Agricultural Sciences, Umeå	16
Swedish University of Agricultural Sciences, Uppsala	2
University of Umea	4
Uppsala University	1
USA	1
University of Washington	1

Appendix D

Table A3. Journals and corresponding publishers of land use conflict in Northern Sweden.

Journals and Publishers	No of Articles
Cambridge University Press	2
Polar Record	2
Canadian Science Publishing	1
Canadian Journal of Forest Research	1
Commonwealth Forestry Association	1
International Forestry Review	1
Elsevier	8
Ecosystem Services	1
Forest Ecology and Management	1
Forest Policy and Economics	3
Journal of Environmental Management	2
Land Use Policy	1
MDPI	2
Forests	2
Oxford University Press	1
International Political Sociology	1
Resilience Alliance	1
Ecology and Society	1
Springer	6

Table A3. *Cont.*

Journals and Publishers	No of Articles
Agroforestry Systems	1
Ambio	1
Environmental Management	2
Human Ecology	1
Journal of Mountain Science	1
Taylor and Francis	8
Journal of Environmental Policy & Planning	2
Journal of Environmental Policy and Planning	1
Journal of Forest Research	1
Polar Geography	2
Polar Research	1
Scandinavian Journal of Forest and Research	1
University of Wisconsin Press	1
Arctic Anthropology	1
White Horse Press	1
Nomadic Peoples	1
Wiley-Blackwell	1
Journal of Applied Ecology	1
World Scientific	1
Journal of Environmental Assessment Policy and Management	1

Appendix E

Table A4. Methodological approaches used to conduct research on land use conflict in Northern Sweden.

Methodological Approaches	No of Articles
Case study	16
Agonistic perspective	1
Collaborative approach	1
Co-management	1
Foucault's governmentality	1
Foucauldian and critical theory	1
Frame analysis	1
Governance and governing	1
Landscape layers	1
Landscape perception	1
Neoliberal governance	1
Social-ecological system assessment	1
Optimal Corridor Construction Approach (OCCA)	1
Place perceptions	1
Interest–power matrix	1
Transaction costs	2
Comparative case study	5

Table A4. *Cont.*

Methodological Approaches	No of Articles
Collaboration theory	1
Guohtun concept	1
Right of Public Access	1
Social Licence to operate	1
STEPS (Social, Technological and Environmental Pathways to Sustainability) approach	1
Historical analysis	3
Colonialization, post-colonialism	1
Concept of samråd	1
Deleuze concepts of smooth and striated space	1
Participatory research	4
Multiple-criteria decision analysis	1
Participatory management	1
Participatory MCDA process	1
Structured Dialogue Processes, or Structured Decision-Making processes	1
Scenario analysis	3
Scenario development	3
Statistical analysis	1
Species richness, abundance and assemblage composition	1
Spatial analysis	1
Spatial clustering	1
Grand Total	33

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